9972GR-VB Datasheet

Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	60	
$R_{DS(on)}$ (Ω)	V_{GS} = 10 V	0.015
Q_g (Max.) (nC)	110	
Q_{gs} (nC)	29	
Q_{gd} (nC)	36	
Configuration	Single	

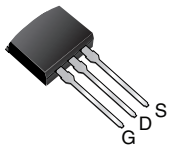
FEATURES

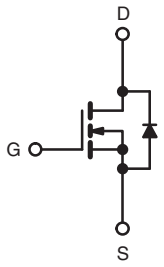
- Advanced process technology
- 175 °C operating temperature
- Fast switching

RoHS* Available

HALOGEN FREE Available

I²PAK (TO-262)





N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER			**SYMBOL**	**LIMIT**	**UNIT**
Drain-Source Voltage			V_{DS}	60	V
Gate-Source Voltage			V_{GS}	± 20	
Continuous Drain Current [f]	V_{GS} at 10 V	T_C = 25 °C	I_D	60	A
		T_C = 100 °C		50	
Pulsed Drain Current [a, e]			I_{DM}	290	
Linear Derating Factor				1.3	W/°C
Single Pulse Avalanche Energy [b, e]			E_{AS}	100	mJ
Maximum Power Dissipation	T_C = 25 °C		P_D	190	W
	T_A = 25 °C			3.7	
Peak Diode Recovery dV/dt [c, e]			dV/dt	4.5	V/ns
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	°C
Soldering Recommendations (Peak temperature) [d]	for 10 s			300	

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. V_{DD} = 25 V, Starting T_J = 25 °C, L = 22 µH, R_g = 25 Ω, I_{AS} = 72 A (see fig. 12).
c. $I_{SD} \leq 72$ A, dI/dt ≤ 200 A/µs, $V_{DD} \leq V_{DS}$, $T_J \leq 175$ °C.
d. 1.6 mm from case.
e. Uses IRFZ48, SiHFZ48 data and test conditions.
f. Calculated continuous current based on maximum allowable junction temperature.

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient (PCB mount) [a]	R_{thJA}	-	40	°C / W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.8	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0, I_D = 250 µA	60	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA [c]	-	0.060	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	1.5	-	3.0	V
Gate-Source Leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	-	-	25	µA
		V_{DS} = 48 V, V_{GS} = 0 V, T_J = 150 °C	-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 15 A [b]	-	0.015	-	Ω
Forward Transconductance	g_{fs}	V_{DS} = 25 V, I_D = 15 A [b]	27	-	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5 [c]	-	3500	-	pF
Output Capacitance	C_{oss}		-	1300	-	
Reverse Transfer Capacitance	C_{rss}		-	190	-	
Total Gate Charge	Q_g	V_{GS} = 10 V, I_D = 12 A, V_{DS} = 48 V, see fig. 6 and 13 [b, c]	-	-	110	nC
Gate-Source Charge	Q_{gs}		-	-	29	
Gate-Drain Charge	Q_{gd}		-	-	36	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 30 V, I_D = 12 A, R_g = 9.1 Ω, R_D = 0.34 Ω, see fig. 10 [b, c]	-	8.1	-	ns
Rise Time	t_r		-	250	-	
Turn-Off Delay Time	$t_{d(off)}$		-	210	-	
Fall Time	t_f		-	250	-	
Internal Source Inductance	L_S	Between lead, and center of die contact	-	7.5	-	nH
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	50[c]	A
Pulsed Diode Forward Current [a]	I_{SM}		-	-	90	
Body Diode Voltage	V_{SD}	T_J = 25 °C, I_S = 72 A, V_{GS} = 0 V [b]	-	-	2.0	V
Body Diode Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = 72 A, dI/dt = 100 A/µs [b, c]	-	120	180	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	500	800	µC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width ≤ 300 µs; duty cycle ≤ 2 %.
c. Uses VBL1615/9972GR-VB data and test conditions.
d. Calculated continuous current based on maximum allowable junction temperature.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

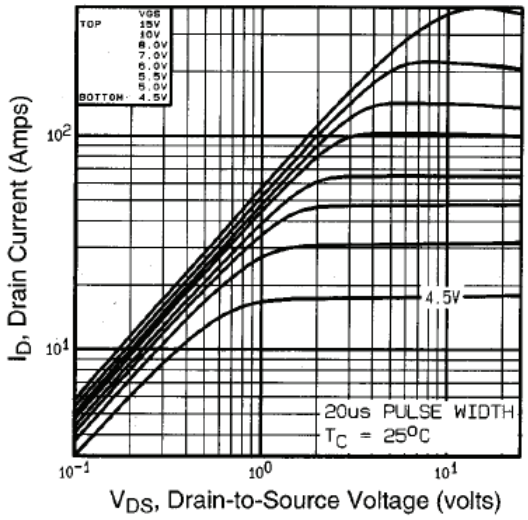


Fig. 1 - Typical Output Characteristics

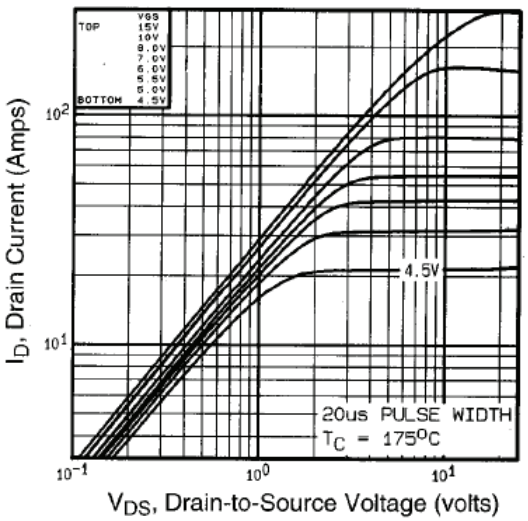


Fig. 2 - Typical Output Characteristics

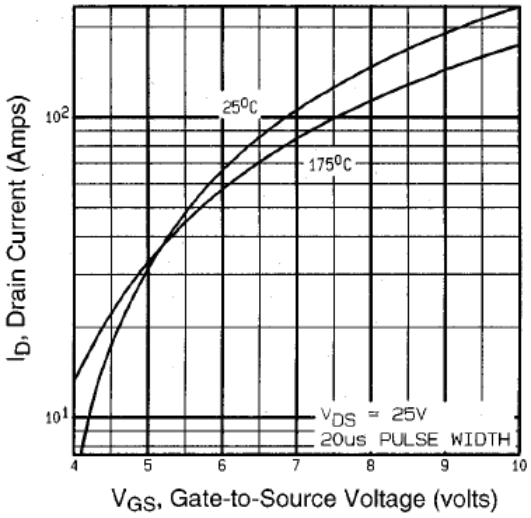


Fig. 3 - Typical Transfer Characteristics

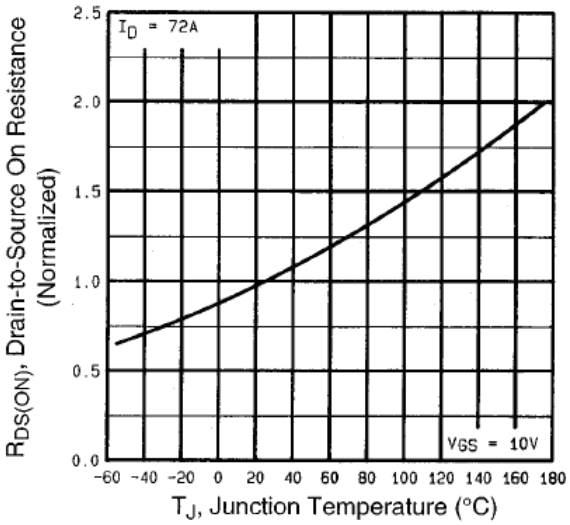


Fig. 4 - Normalized On-Resistance vs. Temperature

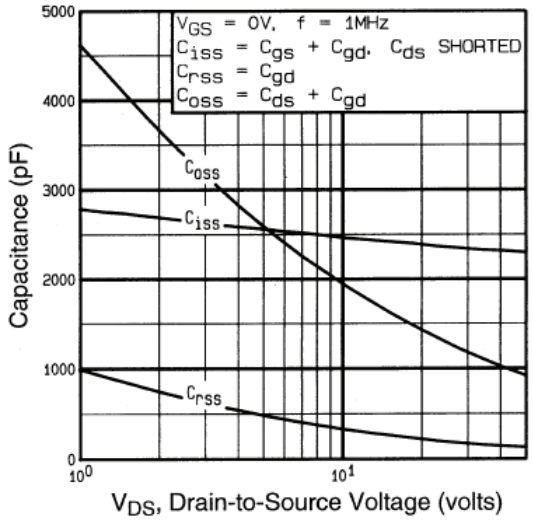


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

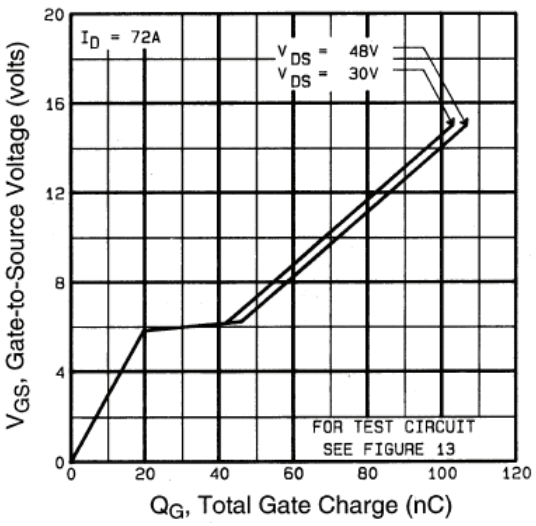


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

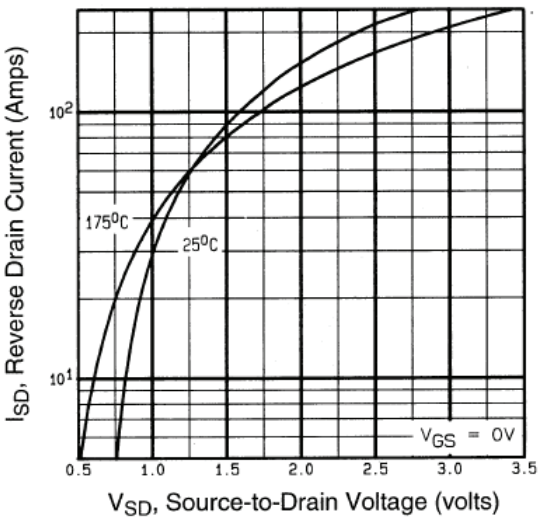


Fig. 7 - Typical Source-Drain Diode Forward Voltage

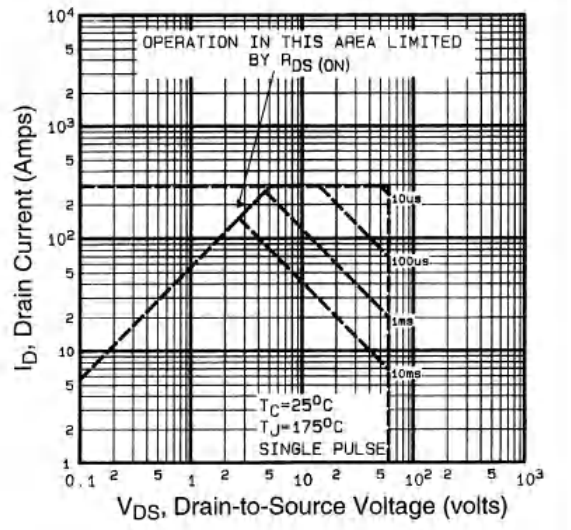


Fig. 8 - Maximum Safe Operating Area

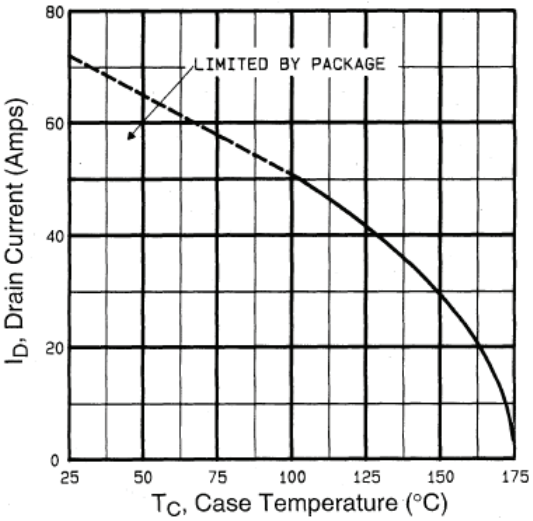


Fig. 9 - Maximum Drain Current vs. Case Temperature

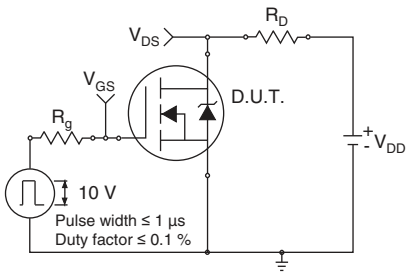


Fig. 10a - Switching Time Test Circuit

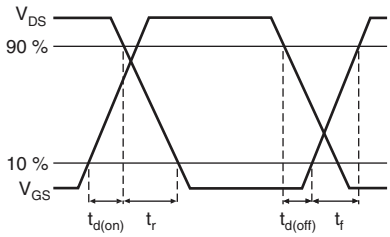


Fig. 10b - Switching Time Waveform

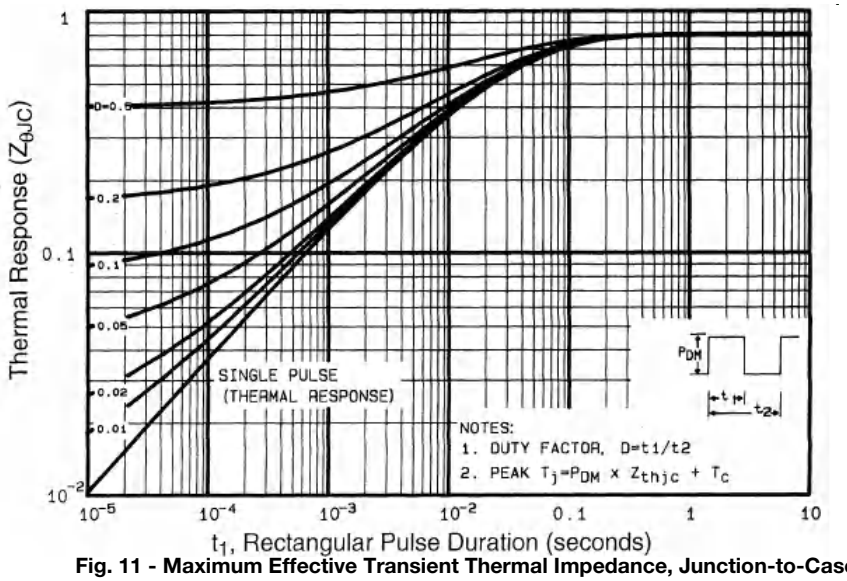


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

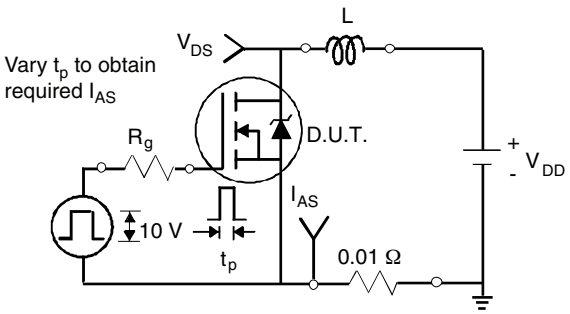


Fig. 12a - Unclamped Inductive Test Circuit

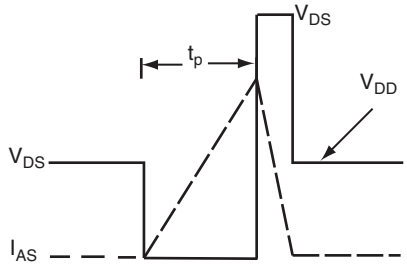


Fig. 12b - Unclamped Inductive Waveforms

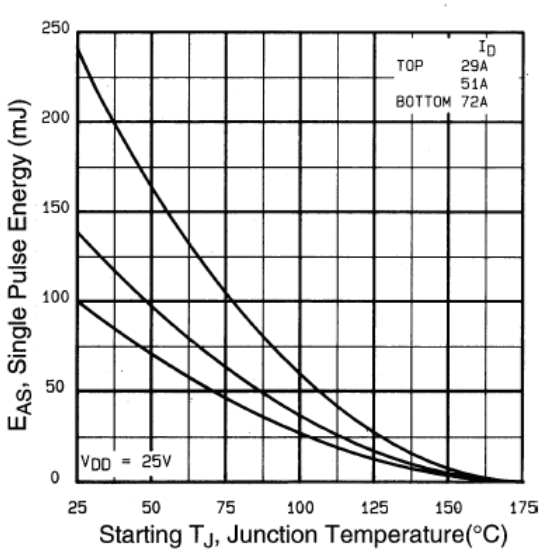


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

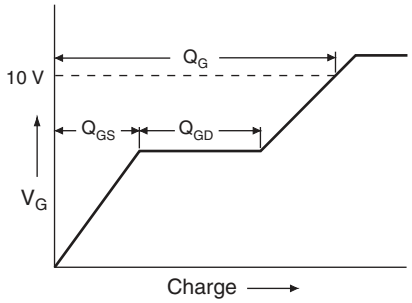


Fig. 13a - Maximum Avalanche Energy vs. Drain Current

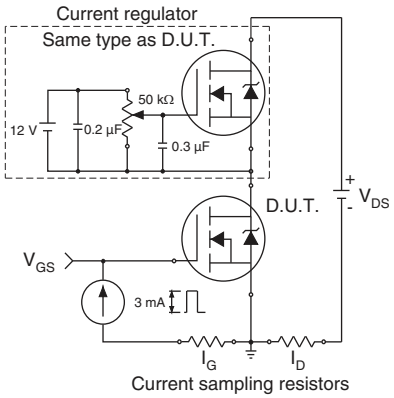
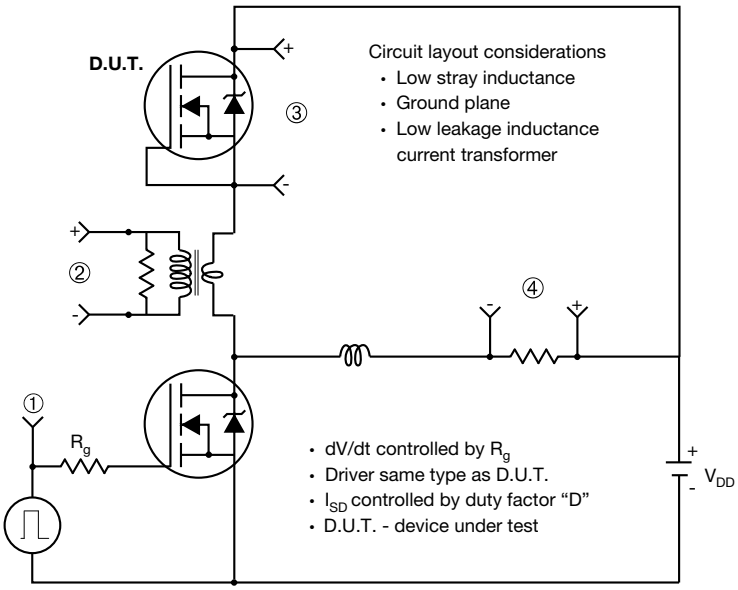
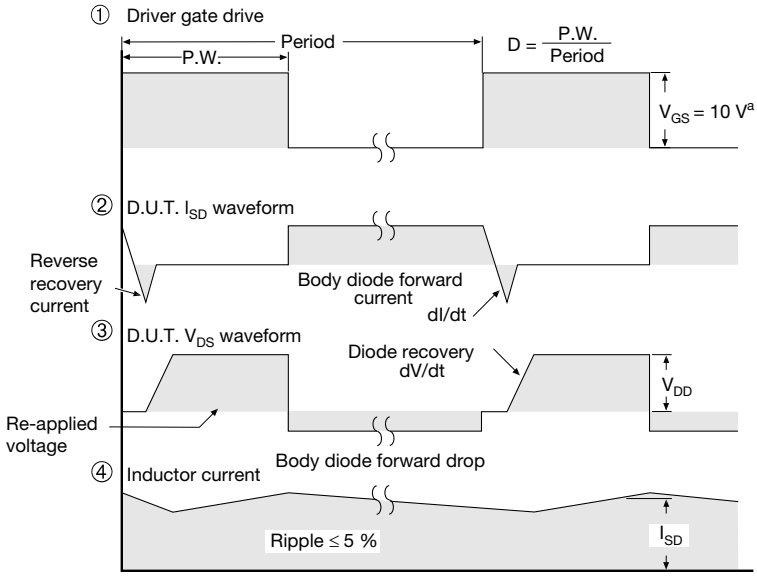


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



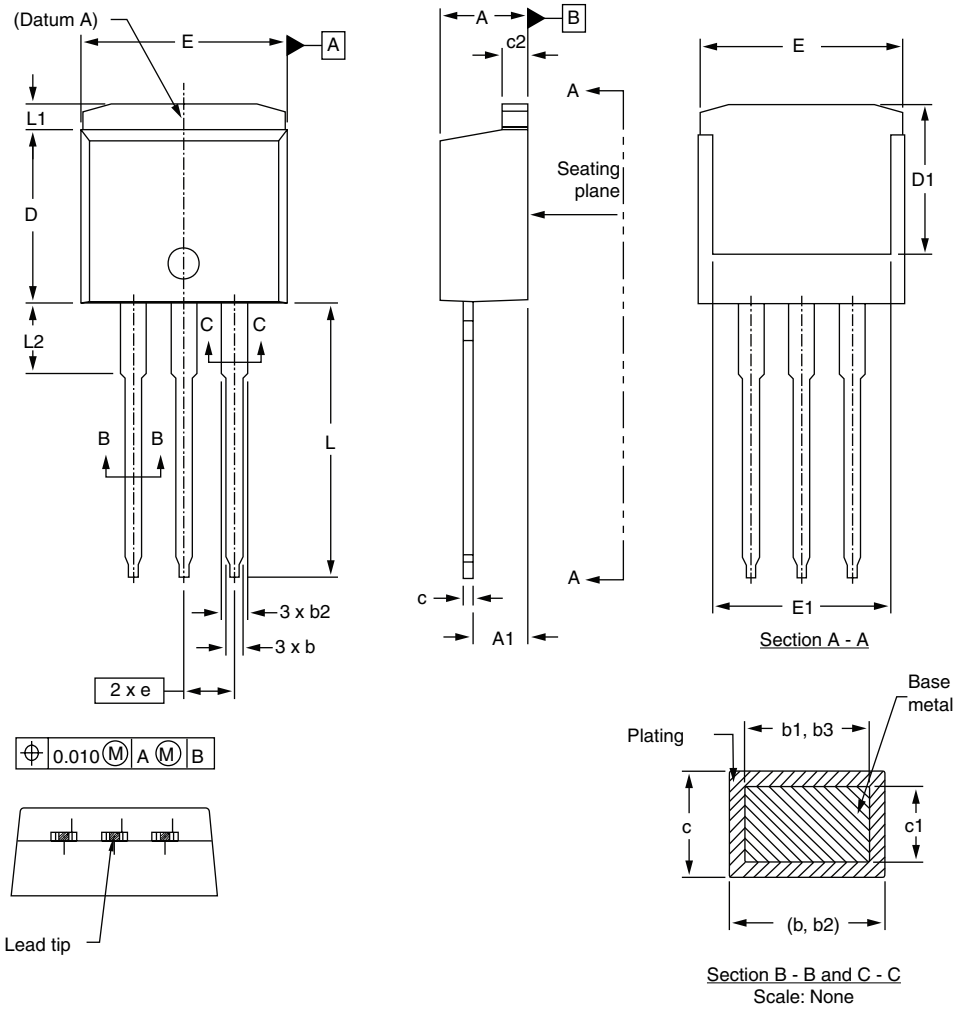


Note

a. V_{GS} = 5 V for logic level devices

Fig. 14 - For N-Channel

I²PAK (TO-262) (HIGH VOLTAGE)



	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	2.03	3.02	0.080	0.119
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
c	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065

	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
D	8.38	9.65	0.330	0.380
D1	6.86	-	0.270	-
E	9.65	10.67	0.380	0.420
E1	6.22	-	0.245	-
e	2.54 BSC		0.100 BSC	
L	13.46	14.10	0.530	0.555
L1	-	1.65	-	0.065
L2	3.56	3.71	0.140	0.146

ECN: S-82442-Rev. A, 27-Oct-08
DWG: 5977

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outmost extremes of the plastic body.
3. Thermal pad contour optional within dimension E, L1, D1, and E1.
4. Dimension b1 and c1 apply to base metal only.

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